

CLAIMS

1. An Ag sputtering target,

wherein the Ag sputtering target has three-dimensional fluctuation of grain sizes not more than 18%; and

5 wherein the three-dimensional fluctuation of the grain sizes measured by:

exposing a plurality of sputtering surfaces by slicing the Ag sputtering target in planes parallel to a sputtering starting surface,

10 selecting a plurality of locations on each of the exposed sputtering surfaces, and

measuring grain sizes D at all the selected locations of all the exposed sputtering surfaces by executing i) to iv) below,

i) taking an optical micrograph of the selected location,

15 ii) drawing a plurality of straight lines equal to or more than four in a grid pattern on the obtained micrograph,

iii) investigating a number n of grain boundaries on each of the straight lines, and calculating a grain size d (unit: μm) for each of the straight lines on the basis of the following formula:

$$d=L/(n \cdot m)$$

20 wherein

L: length of the straight line,

n: number of the grain boundaries on the straight line,

m: magnification of the optical micrograph, and

25 iv) calculating the grain size D at the selected location as an average value of the grain sizes d for the plurality of straight lines;

calculating values A1 and B1 using the formula below and based on the results of measurement of the grain sizes D at all the selected locations of all the exposed sputtering surfaces:

$$A1 = (D_{\max} - D_{\text{ave}}) / D_{\text{ave}} \times 100 (\%)$$

$$5 \quad B1 = (D_{\text{ave}} - D_{\min}) / D_{\text{ave}} \times 100 (\%)$$

wherein

D_{\max} : maximum value among the grain sizes D at all the selected locations

10 D_{\min} : minimum value among the grain sizes D at all the selected locations

D_{ave} : average value of the grain sizes D at all the selected locations; and

selecting larger one of the values A1 and B1 as the three-dimensional fluctuation of the grain sizes.

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2. The Ag sputtering target according to claim 1, wherein the average grain size D_{ave} is not more than 100 μm , and the maximum grain size D_{\max} is not more than 120 μm .

20 3. An Ag sputtering target,

wherein the Ag sputtering target has three-dimensional fluctuation of X-ray diffraction peak intensity ratios (X_2/X_1) not more than 35%; and

25 wherein the three-dimensional fluctuation of the X-ray diffraction peak intensity ratios (X_2/X_1) is measured by:

exposing a plurality of sputtering surfaces by slicing the Ag sputtering target in planes parallel to a sputtering starting surface;

selecting a plurality of locations on each of the exposed sputtering surfaces;

5 measuring the X-ray diffraction peak intensities of the Ag at all the selected locations of all the exposed sputtering surfaces;

calculating the X-ray diffraction peak intensity ratio (X_2/X_1) for each of the selected locations, the X-ray diffraction peak intensity ratio (X_2/X_1) being defined as the ratio of the largest Ag X-ray diffraction peak intensity X_1 in relation to the second largest Ag X-ray diffraction peak intensity X_2 ;

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calculating values A2 and B2 using the formula below and based on the X-ray diffraction peak intensity ratios (X_2/X_1) at all the selected locations of all the exposed sputtering surfaces,

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$$A2 = (R_{\max} - R_{\text{ave}}) / R_{\text{ave}} \times 100 (\%)$$

$$B2 = (R_{\text{ave}} - R_{\min}) / R_{\text{ave}} \times 100 (\%)$$

wherein

R_{\max} : maximum value among the X-ray diffraction peak intensity ratios (X_2/X_1) at all selected locations

20 R_{\min} : minimum value among the X-ray diffraction peak intensity ratios (X_2/X_1) at all selected locations

R_{ave} : average value of the X-ray diffraction peak intensity ratios (X_2/X_1) at all selected locations; and

selecting the larger one of the values A2 and B2 as the three-dimensional fluctuation of the X-ray diffraction peak intensity

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ratio (X_2/X_1).

4. An Ag sputtering target according to any one of claims 1 to 3, having a disc-like shape.

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5. An Ag sputtering target according to any one of claims 1 to 4, formed by Ag alloy containing rare-earth metal.

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6. An Ag sputtering target according to claim 5, wherein a content of the rare-earth metal is not more than 5 atomic percent (not including 0 atomic percent).

7. A method for producing the Ag sputtering target according to any of claims 1 to 6, comprising:

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conducting a cold forging operation one or more times, the cold forging operation comprising,

solid forging an Ag columnar mass so as to be extended in a axial direction thereof, and

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cold upsetting the solid forged Ag columnar mass in the axial direction while maintaining a columnar shape of the solid forged Ag columnar mass; and

slicing a cold-worked columnar mass obtained by the cold forging operation in rounds after being heat treatment.

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8. A method for producing an Ag thin film, comprising:

forming the Ag thin film on a substrate by sputtering using the Ag sputtering target according to any one of claims 1 to 6.